Preparation and Characterization of Nanostructured Granular Support Particles and Catalytic Materials

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We have set up successfully two experimental systems during the past time of the project. One is sol-gel chemical method for preparing γ-Al_2O_3, SiO_2, Cr_2O_3 granular support particles. Another is the laser-induced solution deposition (LISD) technique for nanoparticle catalysts containing Fe/Cu, and Co/Cu on the granular support.

We have prepared γ-Al_2O_3 granular support particles by sol-gel method through three steps: boehmite sol (γ-AlOOH) preparation, sol gelatinization and shaping (oil dropping), and dry and calcinations. The structures were identified by x-ray diffraction (XRD), and the surface morphology, composition and particle size were examined by scanning electron microscope (SEM). The prepared γ-Al_2O_3 granular particles were uniform in composition and structure.

LISD is a novel method for preparing proposed nanoparticle Fe/Cu and Co/Cu catalysts. We have chosen $CoCl_2$, $FeCl_2$, and $CuCl_2$ as precursors (solutes) in the LISD solution deposition. They were dissolved in the solution with various mixtures of solvents of methanol, cyclohexane, tetrahydrofuran (THF) and dielether. The granular γ-Al_2O_3 particles prepared by oil-drop sol-gel method were put at the bottom of the solution. Catalytic samples were analyzed by chemical method, SEM, XRD, magnetization measurements, and other special characterization techniques such as Mossbauer study for Fe, zero filed nuclear magneto resonance (ZFNMR) for Co, and NQR for Cu. The preliminary results have not shown complete success in the formation of bimetallic catalysts as we proposed. Much more work needs to be done in the future to get better results.